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ABSTRACT

The Naval Enlisted Professional Development Information System (NEPDIS) was designed to function as a fully computerized information assembly and analysis system to support labor force, personnel, and training management. The NEPDIS comprises separate training development, instructional, training record and evaluation, career development, and audit subsystems. This report focuses on the front-end analysis process which produces the job task inventory file. Input for the NEPDIS front-end analysis process comes from documented occupational data sources that are entered into the computer by Navy subject matter experts. Computer programs analyze the job task data and produce job task inventory listings that contain all job tasks for a given Navy rating and pay grade. The system can also produce such data as job task inventory terminal learning objectives, task-specific billet descriptions, rating-specific skills, and rating-specific knowledges. The NEPDIS front-end analysis process has had a trial application with four avionics ratings. (This report includes numerous sample NEPDIS and job task inventory outputs.) (MN)

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Technical Report 159

THE NAVAL ENLISTED PROFESSIONAL DEVELOPMENT INFORMATION SYSTEM (NEPDIS): FRONT END ANALYSIS (FEA) PROCESS

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October 1984

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is the second in a series designed to describe the origin, development, and applications of the Naval Education Professional Development Information System (NEPDIS). The first report (Ansbro, 1982), TAEG Report 122, provides an overall description of the subsystems and files of NEPDIS and applications of the NEPDIS. This second report provides a system overview of NEPDIS but focuses primarily on the NEPDIS training development subsystem and especially upon the front-end analysis (continued on reverse)

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(FEA) producing the Job Task Inventory (JTI) File. A third report will describe a conceptual model for using NEPDIS in career planning including descriptions, manpower documents, and training programs.

The NEPDIS was designed to be a fully computerized information assembly and analysis system to support manpower, personnel, and training management. Specific objectives of the NEPDIS are:

- establish a single, centrally managed, comprehensive occupational data base which will provide for mobility within and among enlisted ratings and Naval Enlisted Classifications (NECs)
- identify common tasks across Navy ratings and NECs
- provide an efficient, integrated, and automated training evaluation methodology
- manage ISD-generated data through automated means
- enable Navy managers to make appropriate decisions in meeting special needs or mission requirements by providing them with a complete record of each enlisted person's training and education experiences
- reallocate tasks among pay grades and establish core and finger courses keyed to specific billet assignments
- establish clearly defined career ladders and career-planning alternatives.

The NEPDIS FEA contains the following basic elements:

- job task data base
- job task computer analysis programs.

The NEPDIS FEA uses these elements to build the JTI which provides detailed job task information for Navy ratings. This detailed job task information can be used to build Naval training and enlisted career planning programs to support manpower, personnel, and training management.

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SECTION I

INTRODUCTION

BACKGROUND

The Chief of Naval Education and Training (CNET) has identified a need for a comprehensive Navy occupational data bank. Meeting this need for a job task data base supports CNET's goal to provide "a proficient occupant for every billet in the fleet" (Cagle, 1973, p. 1). Initially, efforts were directed at identifying and evaluating existing systems which have the potential for fulfilling this requirement. A number of occupational data systems which contained portions of the essential information were identified. Among these were occupational data banks supporting Occupational Standards (OCCSTDS), Personnel Qualification Standards (PQS), Engineering Operational Sequencing Systems (EOSS), Advancement-in-Rate Examinations (ARE), and the Naval Occupational Task Analysis Program (NOTAP). The NOTAP supports the OCCSTDS and is also used in advancement examinations and training program development. Despite the fact that such systems exist and meet the purposes for which they were designed, none of them are sufficiently comprehensive to serve all the occupational data needs of the Navy training community.

The occupational data requirements for the Navy training community include:

- a large and comprehensive data base
- technical documentation as the source for obtaining objective job task data
- separating operator/technician jobs from administrative tasks
- an audit trail running throughout the data bases
- computer dialogue with other occupational data banks
- job task data performed on representative as opposed to generic equipment and weapon platforms.

The information contained in OCCSTDS, PQS, EOSS, ARE, and NOTAP (referred to above) were not compatible with each other. Also, since differing methodologies were used in obtaining information for each of these data banks, CNET considered it unlikely that these systems could be merged to meet the occupational data requirements. Consequently, CNET began to develop a dedicated job task data system that would produce occupational data in a form which would meet the Navy's needs.

In an independent but related action, the Chief of Naval Operations (CNO) established an objective to "integrate all training methodologies and instructional programs through the use of a common data base" (OPNAVINST 5310.13). This action was related to the CNET need for a large task data

base because the CNO also made clear his intent to use a single occupational data base to support manpower and personnel requirements and to provide appropriate interfaces with training requirements. This CNO initiative gave impetus to and defined the need for a comprehensive occupational data base for the Navy.

The CNET staff recognized that the data base development which was begun to meet task analysis needs of the Naval Education and Training Command (NAVEDTRACOM) could be made a part of a more comprehensive manpower, personnel, and training management information system. Such a system would be consistent with the CNO's occupational data base objective. This concept, or system, was named the Naval Enlisted Professional Development Information System (NEPDIS). The NEPDIS concept incorporated job/task/skill analysis and career development systems being developed by CNET (CNET, 1977; Davis, 1977, 1977a, 1977b). At the time, these systems were being independently constructed to support the development and management of both training programs and enlisted careers. The job/task/skill or front end analysis (FEA) methodology was originally intended to be an improved occupational data acquisition and analysis system for support of Navy Instructional Systems Development (ISD) (CNET, 1978; Davis, 1976). A part of the enlisted career development system--the training development and the audit trail subsystems--was being experimentally developed to maximize training effectiveness and provide appropriate training for the enlisted man (from recruitment to retirement from the Navy).

While these systems had different purposes, integrating them into a single system furnished an opportunity to construct a Navy occupational data base that could serve the purposes of job analysis, career development, rating and billet description, job qualification, advancement, and personnel assignment.

This report is the second in a series designed to describe the origin, development, and applications of the NEPDIS. The first report (Ansbro, 1982) provides a general overview of the NEPDIS and describes its subsystems. This second report provides a system overview of NEPDIS but focuses primarily on the NEPDIS training development subsystem and especially upon the front end analysis (FEA) producing the job task inventory file (JTI). A third report will describe a conceptual model for using NEPDIS in career planning including billet descriptions, manpower documents, and training programs.

PURPOSE

The purpose of this report is to describe the training development subsystem of the NEPDIS and give a detailed discussion of the job task inventory file in particular. Included in the discussion is a description of the NEPDIS front end analysis process and its major product--the job task inventory (JTI) file.

ORGANIZATION OF THE REPORT

This report contains four other sections in addition to this introduction. Section II provides a system overview of NEPDIS and puts the NEPDIS job task inventory into its larger context. This section also is intended to provide an overview of the NEPDIS system concept. Section II also orients the reader to the Training Development subsystem of NEPDIS and the place of the job task inventory within this subsystem. Readers familiar with TAEG (Code 1) report number 122 (from which this section is taken) may skip section II and go directly to section III. Section III describes the history and structure of the front end analysis process which builds the job task inventory file. Section IV describes the outputs from the job task inventory data base. Section V is a summary of this report.

SECTION II

SYSTEM OVERVIEW

This section (1) presents an overview of NEPDIS as it was originally conceived, (2) describes the overall structure of NEPDIS, (3) outlines each of the major subsystems and files, and (4) discusses the training development subsystem and its files. Also, the purpose and objectives of NEPDIS are presented. Finally, the training development subsystem is presented in more detail than in the overview. The first part of the material in this section is identical to part of the first NEPDIS report (Ansbro 1982, pp. 5-15). It is repeated here to provide continuity for those readers unfamiliar with the contents of that report.

PURPOSE AND OBJECTIVES

The NEPDIS is designed to be a fully computerized information assembly and analysis system to support manpower, personnel, and training management (CNET, 1977). This system includes an occupational data base and a computer-assisted methodology to perform job/task/skill and training analyses.

Specific objectives of the NEPDIS, in accordance with pertinent objectives of OPNAVINST 5310.13, are:

- establish a single, centrally managed, comprehensive occupational data base which will provide for mobility within and among enlisted ratings and Naval Enlisted Classifications (NECs)
- identify common tasks across Navy ratings and NECs
- provide an efficient, integrated, and automated training evaluation methodology
- manage ISD-generated data through automated means
- enable Navy managers to make appropriate decisions in meeting special needs or mission requirements by providing them with a complete record of each enlisted person's training and education experiences
- reallocate tasks among pay grades and establish core and finger courses keyed to specific billet assignments
- establish clearly defined career ladders and career-planning alternatives.

OVERVIEW

The NEPDIS is composed of five major subsystems and is supported by seven primary files (figure 1). The Training Development Subsystem contains the Task Inventory File and the Training Development and Management File.

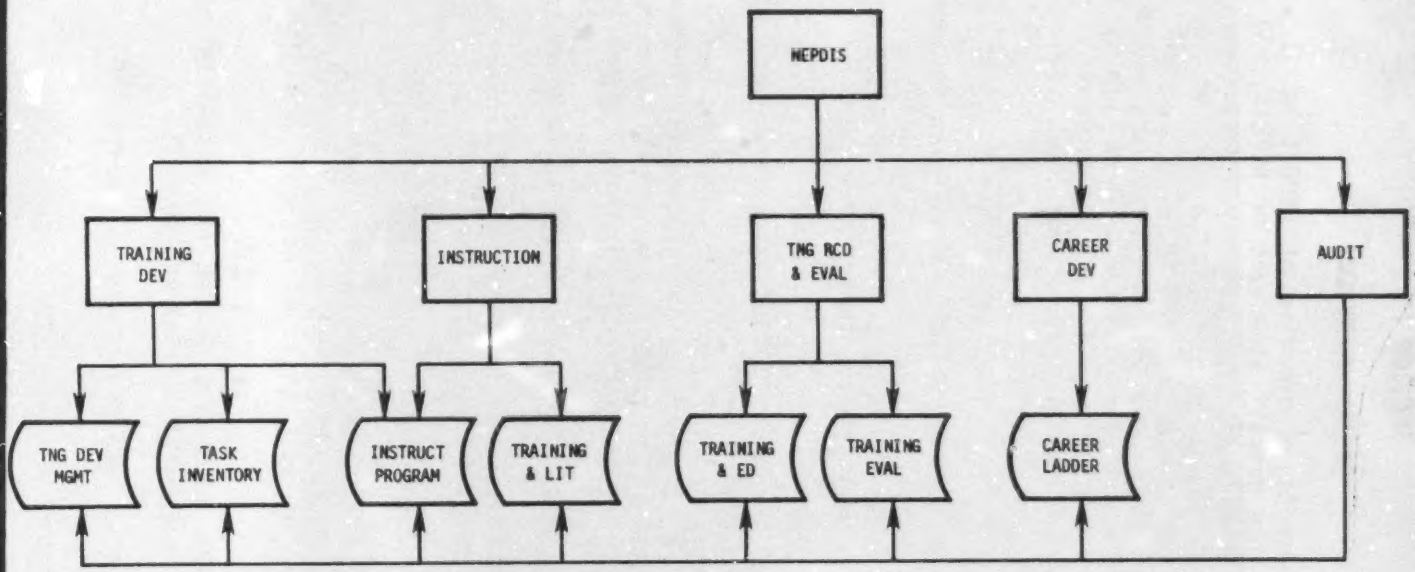

Figure 1. NEPDIS sybsystems and data files.

This subsystem encompasses job/task/skill data acquisition and analyses and maintains training program development records. The Instructional Subsystem is composed of the Instructional Program File and the Training Materials and Literature File. This subsystem will provide a record of all instructional support media and materials and the courses which employ them. The Training Record and Evaluation Subsystem is composed of the Training and Education File and the Training Evaluation File. This subsystem will record individual Navy enlisted personnel biographical and pre-enlistment data, the results of Navy training, and other training and education. The Career Development Subsystem contains only the Career Ladder File. This subsystem will identify career ladders, locate personnel in a career ladder, and project alternate career paths. Finally, the Audit Subsystem will link the data in the various NEPDIS files and explore the impact of practices, policies, and system changes on training. The following paragraphs provide a more detailed description of each of the subsystems and files.

TRAINING DEVELOPMENT SUBSYSTEM. This subsystem provides a mechanism to acquire, store, classify, and analyze job, task, and skill data. The purpose is to more easily identify job/task complexity, establish task interrelationships, determine the degree to which tasks are common, and assign tasks among pay grades as a function of skill level required.

The training development subsystem provides the NEPDIS user with information to develop and implement curricula based on Navy tasks. Its files provide information on the tasks that should be trained as well as methods used to develop the training curricula itself. The primary files in the training development subsystem are the task inventory file and the training development and management file. These two files provide the NEPDIS user with information about the tasks that should be trained and the training development activities being developed to train these tasks.

Task Inventory File. This file is operational. It contains all job/task/skill inventories (JTIs) obtained through the NEPDIS FEA methodology for selected ratings. Front end analysis includes occupational data input from Navy enlisted ratings, NECs, and Navy enlisted occupational groups. The task inventory file identifies and classifies skills and knowledge supporting job task performance. It also provides an audit trail from knowledge elements through skills and into job tasks. The job task inventory file contains the information about front end analysis of the job tasks. The FEA which builds job task inventory file acquires, stores, classifies, and analyzes job/task/skill data.

Training Development and Management File. The prototype software supporting this file has been developed. When completed, the file will maintain a record of all training development activities including development of curricula, training literature, and instructional media. The user will be able to generate a Training Program Development Current Status Report of these activities for a course. The training development and management file maintains records of training development activities. The training development and management file provides information on training program development. This file maintains the records of the current status, actions taken, and responsibilities for training development in the Navy.

The products of the task inventory file are job tasks for each rating while the products of the training development and management file are curricula, training programs, training literature, and training media. Thus, they both serve to provide the Navy trainer with information on what and how Navy job tasks should be trained.

INSTRUCTIONAL SUBSYSTEM. This subsystem, when developed, will provide listings of instructional programs and support items which exist or are under development. The Instructional Program File and the Training Materials and Literature File record instructional support media and materials and identify the instructional programs using these materials.

Instructional Program File. Each Instructional Program File record contains a course synopsis. Computer programs are available to translate task performance data in the master JTI to fully detailed learning objective statements in each record. Statements of objectives can then be arranged to develop curriculum outlines.

Training Materials and Literature File. This file will record all training literature and instructional media associated with an instructional program, regardless of development status.

TRAINING RECORD AND EVALUATION SUBSYSTEM. This subsystem will record biographical and pre-enlistment educational data for each individual and the results of Navy and other subsequent training and education for all enlisted personnel. Also, this subsystem will track an individual student in terms of specific educational and training experiences and will contain data to evaluate courses.

Training and Education File. This file will provide a central comprehensive education and training record for all Navy enlisted personnel. The extent to which training has met objectives can be determined by establishing relationships among skills required on the job, tasks and skills trained in Navy schoolhouses, skills associated with prior work experience, and other formal training.

Training Evaluation File. This file will be designed to summarize training evaluation data from the Training and Education File for the purpose of training program assessment.

CAREER DEVELOPMENT SUBSYSTEM. When developed, this subsystem will provide a means for identifying enlisted career ladders, an individual's position within a given career ladder, and career options open to individuals. This subsystem will assist in identifying the most cost-effective career paths for enlisted personnel.

Career Ladder File. This file will record all enlisted career ladders and will identify (1) the pay grades associated with each career ladder step, (2) the core and finger course training required to achieve each grade, (3) where training may be acquired, and (4) when training is required during any given career continuum.

AUDIT SUBSYSTEM. This subsystem will assess the impact of hardware modifications, operating practice, policy, and doctrine on training. Also, it will provide an overview of the cumulative effect of these impacts on a variety of training system components from job task inventories to instructional programs.

SECTION III

NEPDIS FRONT END ANALYSIS (FEA) PROCESS

This section describes the NEPDIS front end analysis (FEA) process (see figure 2). The NEPDIS FEA process is a part of the NEPDIS training development subsystem (see figure 1). Front end analysis can be defined as the basic method used to obtain a detailed listing of duties, tasks, and elements necessary to perform a clearly defined specific job task. In this section NEPDIS FEA history, task data input, and the task data analysis will be described. The NEPDIS FEA task data outputs including the job task inventory will be described in section IV.

HISTORY OF THE NEPDIS FEA SYSTEM

This section briefly describes the history of the front end analysis (FEA) system that is used to build a Job Task Inventory (JTI).

The beginnings of the present day NEPDIS and FEA started with the Navy enlisted Occupational Classification System (NEOCS) in the early 1970s. NEOCS was intended to accomplish the following purposes:

- streamline NECs, duty assignments, ratings
- increase flexibility in assigning personnel
- better describe work performance
- realign occupational classifications
- improve Navy enlisted training and advancement.

NEOCS rearranged rating structures on the basis of subject matter expert's (SMEs) job experience and Bureau of Personnel Qualifications for Advancement in Rate documents.

In 1974, the Occupational Systems Implementation Group (OCSIG) was formed to redesign training in support of NEOCS; OCSIG, in turn, led to the forming of Occupational Field Implementation Teams (OFITs) which were to develop an occupational rating training system with a total career approach. In 1975, the OFITs were reorganized into the Career Training Analysis Group (CTAG). The CTAG was directed to use the Navy's instructional development system (NAVEDTRA 106A) as its guide for developing its own FEA. The CTAG was primarily an FEA group providing task analysis data to the developers of instructional materials (the Navy's Instructional Program Development Centers (IPDCs)). At the same time the CTAG was providing the course revision task data, it was developing an innovative FEA capability. This innovative FEA process was being developed with the goal of improving existing FEA processes to provide objective task data for a comprehensive occupational data base. Also a CTAG goal was to develop an FEA process that would provide task data information capable of computer analysis. Some of the CTAG FEA suggestions that resulted from this effort included:

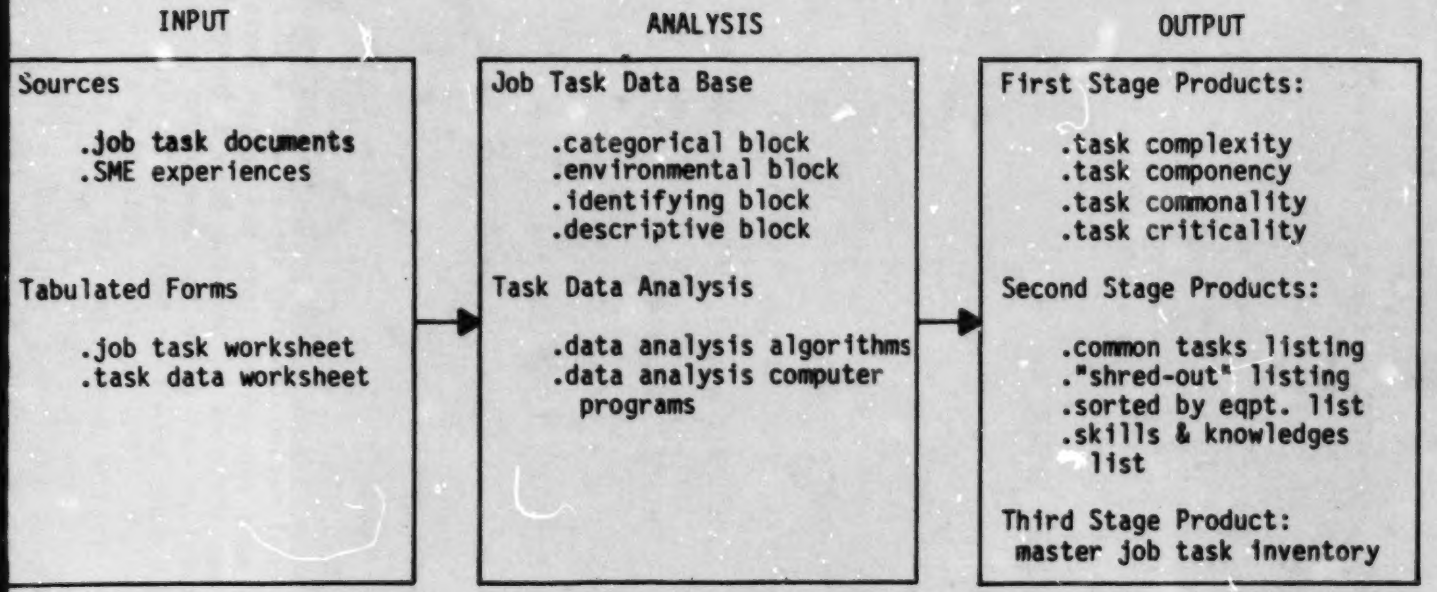

Figure 2. NEPDIS front end analysis (FEA) process.

- beginning the data input with "raw" (nonjudgmental) data
- using task descriptive data alone to satisfy input data requirements
- using a four-part model as an ideal single-task input structure (see figure 3 and the discussion of the data input model)
- obtaining data from officially documented sources.

By the end of 1975, CTAG's dissatisfaction with the existing FEA for occupational data led to the development of NEPDIS and the Job Task Inventory (JTI). CTAG's efforts to develop an innovative job/task analysis methodology resulted in the following FEA accomplishments:

- a preliminary framing of a comprehensive FEA philosophy
- an in-depth needs analysis of the current FEA process
- a detailed workup of a prospective technology to support the FEA philosophy.

In 1976, CNET (N-5) was attempting to organize occupational data into job task inventories to be used for training program development. During this process of working with Navy occupational data, it was observed that the Navy did not have a single comprehensive occupational data bank. What the Navy did have in terms of occupational data bases were the following:

- Occupational Standards (OCCSTDs)
- Personnel Qualification Standards (PQS)
- Engineering Operational Sequence Systems (EOSS)
- Advancement in Rate Exams (ARE)
- Navy Occupational Task Analysis Program (NOTAP).

However, it was concluded that all of these occupational data bases are independent of each other and were not designed nor intended to be combined with any other Navy occupational data base. CNET (N-5) suggested that there should be developed a single, central, comprehensive data base to provide adequate job descriptions for training program development. Thus, the idea of NEPDIS was born--an integrated common data base of occupational data elements compatible with other data systems.

In 1978, CNO published his objectives (OPNAVINST 5310.13), which included a need for a common occupational data base. This data base would provide a commonality of task data elements to support the needs of manpower management, personnel administration, and training development. This need, expressed by CNO for a common data base for all of the Navy, including Navy training, gave further impetus to CNET (N-5) developing a common occupational data base for the Navy.

Thus, NEPDIS and its FEA began about 1976 and continued until about 1982 when the JTI mechanism was developed to the point where it is today.

RATING XX TASK #(SOME CATALOGING SYSTEM) XXXXXXX

CATEGORY OF DUTY (STATEMENT, INDICATOR) XXXXXXXX

TASK STATEMENT XXXXXX (ACTION) XXXXXX (OBJECT OF ACTION) XXXX

(C A T E G O R I C A L)

PLATFORM XXX (SHIP, SHOP, AIRCRAFT) XXXX

SYSTEM XXXXXXXXXXX

EQUIPMENT XXXXXXXXXXXX

COMPONENT XXXXXXXXXXXXX (NUMBER IDENTIFICATION)

MODULE (IF ITEM IDENTIFIED BELOW LEVEL OF COMPONENT) XXXXXX

(ENVIRONMENTAL)

CUE (TO INITIATE TASK PERFORMANCE) XXXXXXXXXXXXXXXXXX

REFERENCE (PUBLICATION, AUTHORITY) XXXXXXXXXXXXXXXXXX

STANDARD (IAW AUTHORITY) XXXXXXXXXXXXXXXXXXXXXXXXXXXX

TOOL(S) XXXXXXXXXXXXXXXXXX

TASK-SUPPORTING EQUIPMENT XXXXXXXXXXXXXXXXXXXXXXXXXX

TASK-SUPPORTING MATERIALS XXXXXXXXXXXXXXXXXXXXXXXXXXX

TASK-SUPPORTING TEST EQUIPMENT XXXXXXXXXXXXXXXXXXXXXX

(IDENTIFYING)

ASSEMBLY OF WORK-BEHAVIOR STATEMENTS, SKILLS, SUBORDINATE WORK ELEMENTS, ETC.

(DESCRIPTIVE)

Figure 3. Task data input structure model.

The present NEPDIS FEA, then, includes a job task analysis system and a job task data base. The NEPDIS JTI data base has the following advantages over other Navy occupational data bases:

- contains an audit trail
- could interact with other data systems (e.g., 3-M data base)
- uses computer analysis versus judgmental decisions.

NEPDIS FEA PROCESS

This section describes the main features of the NEPDIS FEA process which produces the Job Task Inventory File (see figure 2).

The NEPDIS front end analysis (FEA) process is made up of the input (input to the computer), analysis (the computer analysis), and the output (output from the computer). The FEA input is composed of source data tabulated on specially designed forms which can be entered for analyses via computer terminals. The input sources are primarily documented sources which are supplemented by an SME fleet (on-the-job) experience. There are two tabulated forms--job and task data worksheets. These forms give a standard organization to the task data before it is entered into the computer. The input hardware is made up of both microcomputers and main frame computers. These microcomputers are used to input task data into the data base in the main frame computer.

The FEA analysis is accessible only through the main frame computer. The basic components of the system are the task data base and the task data analysis. The job task data base is comprised of both identifying information (information block) and descriptive information ("signature" block). This task data base provides the raw data for enlisted personnel's job task training and career development. The task data analysis consists of data processing and analysis algorithms and computer programs derived from those algorithms. These programs sort, manipulate, and analyze the job task data in the data base.

The FEA process output can be characterized as consisting of three parts: first stage output products, second stage output products, and the final (or third) stage output product. The first stage outputs are the job task measures--task complexity, task commonality, task componency, and task criticality (these terms are defined in the task inventory analysis section). These task measures serve in the data analysis process and as FEA outputs as well. The second stage FEA outputs are various sortings of the task data--common tasks, "shred-outs," equipment sortings, and sortings by skill and knowledge requirements. These occupational data sortings serve as various occupational data listings needed by the NEPDIS user. The final stage FEA output is the master JTI. It is a comprehensive occupational data base listing for all tasks in each Navy rating. Following is a listing of the elements within each of the three major areas of the NEPDIS FEA:

INPUT

- Sources of job task data
- Tabulated forms
- Data entry into computer.

ANALYSIS SYSTEM

- Forming data base in computer (Task Descriptive Characteristics)
- Analyzing the data base with computer programs
  - .. analysis algorithms
  - .. analysis computer programs and routines.

OUTPUT

- First stage output products (these terms are defined in the task inventory analysis section below)
  - .. task complexity
  - .. task commonality
  - .. task componency
  - .. task criticality.
- Second stage output products
  - .. common tasks
  - .. "shred-outs"
  - .. sorted by equipment
  - .. skills and knowledge.
- Final stage output product - Master job task inventory file.

INPUT

The job task data is input into the computer by Navy enlisted SMEs. The following describes various aspects of the NEPDIS FEA input.

TASK DATA INPUT SOURCES. The major source of the FEA input is documented occupational data rather than subject matter expert's (SMEs) judgment. These authoritative sources provide a basis for defining the Navy's job tasks. Examples of these authoritative Navy job task sources are:

- Navy technical manuals
- Navy instructions
- Equipment contract specifications
- Ship and squadron manpower documents
- Personnel Qualification Standards (PQS)
- Data systems (e.g., 3-M)
- Occupational Standards (OCCSTDs)

- Navy Enlisted Occupational Classification System (EOSS)
- Navy Occupational Task Analysis Program (NOTAP)
- Training and instructional documents
  - .. rate training manuals
  - .. correspondence courses.

The sources described above are supplemented by Navy SMEs guiding the input process, but the primary input comes from the documented sources. This documented input is formatted to fit the FEA input structure. The SMEs adhere strictly to the input procedure to assure an objective and reliable input into the task inventory data base.

DATA INPUT MODEL. Only task descriptive data are entered into the computer data base. The Task Data Input Model (see figure 3) consists of four aspects: categorical, environmental, supporting, and descriptive task data information. The categorical task information is basically the task statement. It tells the action performed by the job incumbent plus the object (equipment, tool, platform, etc.) on which this specific task is performed.

The environmental task information identifies the worksite environment and the level of the task down to the component level. This information tells the specific setting in which the task is performed.

The identifying information in figure 3 describes the supporting materials and standards for each task entered into the data base. Such items as cue, reference, standard, and tools are called for in this aspect of the input model.

The descriptive information supplies the detailed work behaviors of the task. Information such as skills and subordinate work elements are asked for to supply the data input information required.

TASK INPUT. Using the NEPDIS FEA, the tasks put into the task data base are "real world" job tasks performed on specific equipment by Naval personnel. The job task data input is made when the user is developing the task data base. Job task data should not be introduced in the later stages of analyzing the task data base because data at these later stages of data processing are no longer raw descriptive data--the task data have been modified and processed by the computer. Therefore, new raw data would not be able to be combined with the processed data if it were attempted to be introduced at later stages of the FEA process. So, each time new data must be added to the NEPDIS job task data base, it needs to be introduced at the beginning of the FEA process. An audit trail is established at this stage of the NEPDIS FEA by citing the data sources along with their corresponding tasks in the data base. The actual items in the data base will be described in the data base section below. Only the fewest number of descriptive data elements should be used to describe each task in the data base. These are the fewest number of descriptive items needed to adequately describe each task for computer analysis. The minimum acceptable descriptive data elements describing each task is dictated during the task input process by

the job task information required on the tabulated forms (job data and task data worksheets) described below.

The size and scope of the task inventory reflects the following aspects of job tasks:

- the platform on which the task is performed (only a representative sample of weapon platforms is sought to be included in the JTI for any given rating)
- the system in which the task occurs (all systems in the Navy will be represented in the task inventory)
- the equipment on which the task is done (only a representative sample of equipments is needed for any given rating in the JTI)
- the component of the task being described (all components of the task will be represented in the task inventory).

The selection criteria for including representative platforms and equipments (cited above) in a rating specific JTI are based on the following:

- how widely distributed the task is in the fleet
- the task predicted service life
- how standardized or typical the item is
- the most complex task of its class
- extent or degree of the commonality of the task's component parts.

The above selection criteria are augmented by reference documents and SME experiences in the fleet. To prepare the task data to be entered into the data base, the SME expresses the descriptive data for the subcategories in quantifiable terms and enters this data into the task inventory. The SME enters the task data into the data base categories also on the basis of his recall of his relevant job experience and the information he gains from a technical document search.

INPUT WORKSHEETS

The job and task data worksheets (see figures 4 and 5) used for recording the necessary task data are tabulated data forms having fill-in items for each task. The Job Data Worksheet (figure 4) has basically the same content as the task input model (see figure 3)--the categorical information (top left corner of figure 4), the worksite environment information (upper left corner of the worksheet), and finally, the identifying information (lower half of the worksheet). Note that this worksheet (figure 4) has been filled in with data from an actual task in the AT rating (indicated in the top left corner.) The number and word entries in figure 4 are task

RATING AT NEC AT-6671

MAJOR FUNCTIONAL CATEGORY: MTN(I) WUC/EIC

PLATFORM	P-3B	APBC
SYSTEM	HF COMM	61000
EQUIPMENT	AN-ARC 94	61180
COMPONENT		
MODULE		

DUTY SUBCATEGORY	TASK ACTION	TASK ACT. CODE	CUES	STANDARDS	REFERENCES	CONDITIONS: TOOLS	SUPPORT MATERIALS	SUPPORT EQUIPMENT	TEST EQUIPMENT	OTHER CONDITIONS	AN/ARC 94 HF COMM (61180)	FEET (61180)	CONTROL UNIT (61180)	ANTENNA COUPLER (61X1280)	MOUNT (61X1280)	ANTENNAS (61X1280)	WIRING	CONNECTORS
1	PERFORM OPERATIONAL CHECK	POC	1,2,3	1	1,2	/	/	1,2,3	/	1	1							
2	REMOVE/REPLACE	RAR	4,5	1	1	1	1	/	/	1		2	3	4	✓			
2	REMOVE/REPLACE	RAR	4,5	1	1	1,2,3	3,4	4	1	1						6		
2	REMOVE/REPLACE	RAR	4,5	1	1,2	1,4	2	1	/	1							7	8

CUES
1. MALFUNCTION
2. MRC
3. REPAIR COMPLETE
4. FAULT ISOLATION

REFERENCES
1. NAØ1-TSPAA-2-6.1
2. NAØ1-TSPAA-2-1

SUPPORT MATERIAL
1. SAFETY WIRE
2. SOLDER (50-50)
3. SILICONE COMP MIL-S-8660
4. SEALING COMP MIL-S-8516

TEST EQUIPMENT
1. TENSIOMETER (3½ lbs)

STANDARDS
1. IALC REFERENCE PUBS

TOOLS
1. COMMON HAND TOOLS (E)
2. ANTENNA WIRE RETRIEVER 14A03
3. MAST PLUG DRIVER 14A06
4. SOLDERING IRON (ST-60W)

SUPPORT EQUIPMENT
1. POWER UNIT NC-10
2. AIR CONDITIONER NR-1
3. HEADSET/MIKE
4. MAINTENANCE PLATFORM

OTHER CONDITIONS
1. "O" LEVEL MAINTENANCE

JOB DATA WORKSHEET NEPD 1500/4 (Rev. 2-77) | ORIG ✓ | OPS | XDGT | QA | COPY | DATA SYS (ORIG) | OP | DATA SYS | FILE | PAGE 1 OF 6 OF PACKAGE 0004

Figure 4. Filled-out Job Data Worksheet for NEPDIS data input (FEA).

Rating: AE

Package: 02

Behavior-action statement

TASK	GENERAL SUBCATEGORY	DUTY SUBCATEGORY	SKILL AREA 1	SKILL AREA 2	SKILL AREA 3	SKILL AREA 4	SKILL AREA 5
20	A 0 1 (2) 3	A 0 1 (2) 3	(A) 0 1 2 3	A 0 1 2 3	A 0 1 2 3	A 0 1 2 3	A 0 1 2 3
	B 0 (1) 2 3	B 0 1 (2) 3	B 0 1 2 3	B 0 1 2 3	B 0 1 2 3	B 0 1 2 3	B 0 1 2 3
	C 0 (1) 2 3	C 0 1 (2) 3	C 0 1 2 3	C 0 1 2 3	C 0 1 2 3	C 0 1 2 3	C 0 1 2 3
	D 0 1 2 (3)	D (0) 1 2 3	D 0 1 2 3	D 0 1 2 3	D 0 1 2 3	D 0 1 2 3	D 0 1 2 3
	E 0 (1) 2 3	E 0 (1) 2 3	E 0 1 2 3	E 0 1 2 3	E 0 1 2 3	E 0 1 2 3	E 0 1 2 3
	F 0 (1) 2 3	F 0 1 2 (3)	F 0 1 2 3	F 0 1 2 3	F 0 1 2 3	F 0 1 2 3	F 0 1 2 3
	G 0 (1) 2 3	G 0 (1) 2 3	G 0 1 2 3	G 0 1 2 3	G 0 1 2 3	G 0 1 2 3	G 0 1 2 3
	H 0 (1) 2 3	H (0) 1 2 3	H 0 1 2 3	H 0 1 2 3	H 0 1 2 3	H 0 1 2 3	H 0 1 2 3
	I 0 1 (2) 3	I 0 1 2 3	I 0 1 2 3	I 0 1 2 3	I 0 1 2 3	I 0 1 2 3	I 0 1 2 3
	J (0) 2 3	J 0 1 2 3	J 0 1 2 3	J 0 1 2 3	J 0 1 2 3	J 0 1 2 3	J 0 1 2 3
	K 0 1 2 3	K 0 1 2 3	K 0 (2) 3	K 0 1 2 3	K 0 1 2 3	K 0 1 2 3	K 0 1 2 3

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Task-action-and object-descriptive level

Figure 5. Filled-out Task Data Worksheet for NEPDIS data input (FEA).

identification data. Categorical information (top left of worksheet) is identified for each task. The handwritten words under the column heading "task action" describe the task behaviors to be performed. Other categorical information are the major functional category and the duty subcategories. The number "1" written in by the major functional category in figure 4 indicates that this is a maintenance task (see figure 6). The numbers under the duty subcategory heading indicate the duty subcategories of this task--1 (checking) and 2 (performing corrective maintenance) (see figure 6). Environmental data is also shown for the task in the Job Data Worksheet (extreme left top). The words written next to platform, system, and equipment identify this task as being performed on high frequency communications equipment in the P-3 aircraft. Identifying data is shown in the middle and lower half of the worksheet. The numbers under the columns below the word "conditions" refer to the handwritten words next to the numbers under each identifying category at the bottom of the worksheet. For example, the numbers 1, 2, 3 under cues at the top middle of the worksheet refer to "malfunction," "MRC," and "repair complete" written under "cues" at the left lower part of the worksheet. Most of the discriptive data while not found in the job data worksheet is found in the task data worksheet (figure 5) described below. This worksheet organizes and standardizes the descriptive input data before it is entered into the computer.

The task data worksheet (figure 5) allows the SME to record the descriptive task data (see figure 3) in coded form which can later be entered into the computer by an optical scanner. The skill areas of the task and subcategories of the task are listed on the task data worksheet: the task number is listed, the task-action-and-object-descriptive levels, and behavior action statements are listed in coded form in the columns in the worksheet. The task-descriptive data (behavior action statements and task-action-and-object-descriptive levels) used to describe specific task behaviors for each task are listed in figure 7. Note that figure 7 lists the task descriptive characteristics appearing in coded form in figure 5 (i.e., the meanings of the behavior action statements and task-action-and-object-descriptive levels in coded form in figure 5 are specified and illustrated in figure 7). The letters in the task data worksheet are coded with task descriptive statements that are stored in the computer, which, when identified by the letters and numbers on the worksheet, describe the unique characteristics of a given job task. This task data worksheet organizes and standardizes the descriptive input data before it is entered into the occupational data base in the computer. Note that this worksheet has been filled out for an actual AE job task.

These combined forms (figures 4 and 5) become the Job Data Worksheet input package used to organize the job task data, facilitating its input into the computer data base. These worksheets are examples of how tabulated shorthand data input methods were introduced in the NEPDIS FEA to simplify the process of organizing and entering data into the computer data base.

COMPUTER HARDWARE. The task descriptive data are entered into the computer data base from the data worksheet and matrix. The computers presently used to enter this data are a desk top microcomputer (TRS-80) and a main frame computer at the University of West Florida (Amdahl, 1470).

MAJOR FUNCTINAL CATEGORIES	DUTY SUBCATEGORIES			SKILLS
1. MAINTENANCE	0. General	7. Constructing	14. Performing honors/ceremonies	1. Using references
2. FABRICATION/PRODUCTION	1. Checking/testing/ inspecting	8. Destructing	15. Standing watches	2. Using tools
3. OPERATIONS	2. Performing corrective maintenance	9. Counseling	16. Performing first aid/ health functions	
4. ADMINISTRATIVE SERVICES	3. Operating equipment for designed mission	10. Training	17. Performing disaster preparedness functions	3. Using support materials
	4. Performing clerical functions	11. Performing safety functions	18. Performing damage control functions	4. Using support equipment
5. PERSONAL SERVICES	5. Supervising/managing	12. Performing security functions	19. Housekeeping (general)	5. Using test equipment
6. MILITARY	6. Designing	13. Performing logistic functions	20. Performing other assigned functions	
			21. Performing preventive maintenance	

Figure 6. Major functional categories, duty subcategories, and task skills.

Behavior Action Statements

AE-0001-0020
PERFORM MAINTENANCE CHECK ON ROTATING BEACON ASSEMBLY (44126)

GENERAL	A	Follow safety precautions (consequences	2
	B	Respond to cues (speed)	1
	C	Gain access (accessibility)	1
	D	Make adjustments/take measurements	3
	E	Continue until completion	1
	F	View/manipulate (miniaturization)	1
	G	Handle/reposition objects (size/shape)	1
	H	Handle/reposition objects (weight)	1
	I	Handle/reposition objects (fragility)	2
	J	Make computations	0
DUTY SUBCATEGORY 01 CHECK TEST INSPECT	A	Observe/analyze indications (dynamics)	2
	B	Observe/analyze indications (sensors)	3
	C	Observe/analyze indications (no of ind)	2
	D	Troubleshoot/fault isolate (procedures)	0
	E	Manipulate controls (number/type)	1
	F	Monitor items (number/type)	3
	G	Monitor items (position)	1
	H	Calibrate/re- ems (procedures)	0
	I	Remove/r	
	J	Make/	
	K	Cl	
SKILL 1 USE REFERENCES	A	Us	
	B	Se	
	C	Lo	
	D	Do	
	E	In	
SKILL 2 USE TOOLS	A	S/	
	B	U	
	C	M	
	D	M	
SKILL 3 SUP MAT	A	Si	
SKILL 4 USE SUPPORT EQUIPMENT	A	Se	
	B	Pos	
	C	Man	
	D	Mak	
	E	Mak	
	F	Op	
	G	Or	
	H	M	
	I	I	
	J	I	
	K	I	
SKILL 5 USE TEST EQUIPMENT	A	S	
	B	F	
	C	M	
	D	O	
	E	M	
	F	M	
	G	O	
	H	C	
	I	I	
	J		

GENERAL (B)

A. FOLLOW SAFETY PRECAUTIONS (CONSEQUENCES)

1. SAFETY IS OF LITTLE CONSEQUENCE; VIOLATIONS SHOULD NOT CAUSE DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL.

2. VIOLATION MAY CAUSE MINOR DAMAGE TO EQUIPMENT AND/OR MINOR INJURY TO PERSONNEL.

3. VIOLATION MAY CAUSE MAJOR DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY OR DEATH TO PERSONNEL.

B. RESPOND TO INITIATING CUES (SPEED OF RESPONSE)

(CONCERNS REACTION TIME AFTER RECEIVING THE CUE TO DO THE TASK)

1. IMMEDIATE RESPONSE NOT REQUIRED--ALLOWS AMPLE TIME FOR RESEARCH IF NECESSARY.

2. QUICK RESPONSE--DOES NOT ALLOW TIME FOR RESEARCH. ACTION MUST BE TAKEN AUTOMATICALLY FROM LEARNED RESPONSES.

3. INSTANT RESPONSE--ACTION MUST BE TAKEN AS FAST AS HUMANLY POSSIBLE; USUALLY AN EMERGENCY CONDITION.

C. GAIN ACCESS TO TASK OBJECT (ACCESSIBILITY)

(CONCERNS GETTING TO THE OBJECT TO BE WORKED ON)

1. EASILY ACCESSIBLE; LITTLE CONSEQUENCE IN COMPLEXITY OF TASK.

2. MODERATELY ACCESSIBLE. E.G., REQUIRES OPENING DRAWERS, REMOVAL OF PLATES, PANELS, BOOTS, COVERS OR MINOR COMPONENTS.

3. DIFFICULT TO GAIN ACCESS. E.G. REQUIRES DISASSEMBLY.

Task-action-and object-descriptive levels

Figure 7. Task descriptive characteristics (TDC).

BEST COPY AVAILABLE

ANALYSIS SYSTEM

The Analysis System in the NEPDIS FEA is made up of two parts:

- task inventory data base
- task inventory data analysis.

Both of these task analysis elements exist in machine readable form and are accessed and used by means of the computer. The following will describe these analysis elements individually.

TASK INVENTORY DATA BASE. The occupational data base covers the work performed by Navy personnel on representative platforms and equipment within a given rating. This data base is intended to be a large, comprehensive job task data base.

A suitable task inventory requires not only a generic task statement but additional work behavior information. Other such work behavior information is subordinate or component work behaviors. Descriptive work behaviors are such behaviors as checking, testing, and inspecting for a maintenance task. Descriptive work behavior information includes such items as cues, standards, tools, equipment, etc. Thus, each task entered into the task inventory data base will have both task identifying information and the generic task statement. The task identifying information uses job task data from real Navy occupational tasks and this information is supported by appropriate document sources. The generic task statement is sorted into component work behaviors, skills, and job knowledge.

Work descriptive items (or sometimes called coded element items) are necessary to describe a job task in both the fleet and Navy training. These descriptive items are an essential part of the audit trail running throughout the Job Task Inventory (JTI) and allows the task data to be traced from FEA outputs back to the original FEA input.

The task inventory data base is basically structured in a task hierarchy. That is, some tasks are more general and include aspects (components) of other tasks. These tasks would be higher in the hierarchy. Other tasks are very specific or they are unique. These tasks would be lower in the hierarchy. The task hierarchy comes about in the following way. First of all, representative aspects of job tasks are chosen. From these representative aspects, the unique job characteristics (task "signatures") of individual job tasks are identified. These task "signatures" make possible task inventory entries into the computer data base for individual tasks. The FEA analysis programs sort these tasks "signatures" into hierarchical relationships. Thus, the task hierarchy is formed in this manner.

The entire structure of the data base and the accompanying analysis programs are keyed to job tasks. Tasks are supported by task elements, task elements by component skills, and skills by arrays of job-related information. The tasks are formed into a hierarchy with the more complex

(embodying) tasks at the top and the simpler (embodied) tasks at the bottom. This hierarchy of tasks is the data base structure upon which the analytic formulas and computer programs carry out the task data FEA analysis.

The data base format is detailed, comprehensive, and extensive. This data base format is basically a four block array consisting of a categorical, environmental, identifying, and a descriptive data block (see figure 8). Job task descriptive data are entered for single tasks in the master JTI printout format. This format is made up of the following job task information blocks (compare with figure 3):

- task statement (categorical data--block 1)
- worksite environment (environmental data--block 2)
- supporting materials or task standards (identifying data--block 3)
- detailed work behaviors (descriptive data--block 4).

These are the same categories as in the Job Task Input Model (see figure 3). This printout format (figure 8) provides the basic information for each job task in the JTI. There exists a capability to set up a dialogue between this occupational data base and other computerized technical and manpower accounting data bases such as 3-M and NOTAP.

TASK INVENTORY ANALYSES. The task inventory analyses are a set of data analysis algorithms and computer routines. Both the task inventory data base and the task inventory analysis computer routines exist in machine readable form and are accessible only through the computer. Together, the data base and the analysis routines make up the analysis system in the task inventory file of the NEPDIS system (see figure 2).

The task inventory analysis (or job task data analysis) is an automated procedure carried out by computer programs. The computer systematically (i.e., a uniform, repetitive, and definitive analysis) analyzes the job task data in the task inventory data base. Using the computer to analyze task data ensures fast, objective, and reliable analysis.

The task inventory analysis required a job task behavior ranking structure to show the relationship among task elements and knowledge items. Defining these relationships (job task structure) allowed these existing task structure relationships to be measured within the task descriptive data hierarchy. Also, identifying these relationships makes it possible for the audit trail to be used in sorting or locating data entries that have common task elements or knowledge items.

Certain criteria were developed to aid in analyzing the job task data. The following are task-descriptive and evaluative criteria that can be quantified, compared, or matched by the computer:

RATING = AE * PACKAGE = 0001 TASK = 0020 DUTY SUBCATEGORY = 01

(1)

TASK STATEMENT = PERFORM MAINTENANCE CHECK ON ROTATING BEACON ASSEMBLY 44126

(2)

PLATFORM = P-3 A/B (APBC)
SYSTEM = LIGHTING SYSTEM (44000)
EQUIPMENT = EXTERIOR LIGHTING (44100)
COMPONENT = ROTATING BEACON ASSEMBLY (44126)

(1) * COMPLEXITY = 1.67

MAJOR ACTION CATEGORY = MAINTAIN
DUTY SUBCATEGORY (01) = CHECK/TEST/INSPECT
TASK ACTION (PMC) = PERFORM MAINTENANCE CHECK

CUE.....REPAIR COMPLETE
STANDARD.....IAW REFERENCE PUBLICATION
REFERENCE.....NA-01-75PAA-2-12
(3) TOOL.....COMMON HAND TOOLS, SPECIAL HAND TOOLS
SUPPORT MATERIAL.....FUSE/SWITCH
SUPPORT EQUIPMENT.....POWER UNIT 28V 400HZ
TEST EQUIPMENT.....RPM GAUGE, AMMETER, MULTIMETER

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
GENERAL	2	1	1	3	1	1	1	1	2	0	0	0	0	0
DUTY SUB 01	2	3	2	0	1	3	1	0	0	1	0	0	0	0
SKILL 1 (REFERENCE)	2	1	1	1	1	0	0	0	0	0	0	0	0	0
(4) SKILL 2 (TOOL)	3	3	2	1	0	0	0	0	0	0	0	0	0	0
SKILL 3 (SUPPORT MATRL)	2	0	0	0	0	0	0	0	0	0	0	0	0	0
SKILL 4 (SUPPORT EQUIP)	1	1	1	1	0	3	0	0	0	0	0	0	0	0
SKILL 5 (TEST EQUIP)	3	2	2	3	2	2	2	1	3	0	0	0	0	0

Figure 8. Single-task entry (model) in master JTI.
(Final revision-data printout format)
(*Items added)

- commonality
- complexity
- componency
- criticality.

Commonality is a task-to-task relationship which is determined by matching the identifying and descriptive data of each task. The task analysis computer program matches component descriptors between tasks to determine the degree of component similarity among job tasks.

Complexity is an index number displaying the position of a task in a vertical hierarchy of job task rankings as indicated by an analysis of its task-descriptive data. The computer programs analyze this task data and record the complexity index in the printout format of the JTI. Complexity should not be interpreted to mean "learning difficulty" or "task difficulty." These variables are influenced by the task performer whereas complexity is a characteristic of the job task only.

Componency is an ascending or descending order of task inter-relationships (data-matched hierarchies). It is a vertical hierarchy of work behavior span. In this hierarchy, tasks of greater work span include those job tasks of lesser work span (all the work behaviors of those with lesser span are included in those of a greater span). In such a behavior, large-scope, multi-behavior, high-componency job tasks also have higher complexity than those of lesser behavioral content.

Criticality is a measure of the importance of performing a particular task in an assigned job. Because of its importance in performing a skill, criticality, therefore, appears to be a variable in task element data. Criticality was a job task evaluative criterion that was more difficult to quantify than commonality, complexity, and componency. For this reason, using criticality in task data analysis was reserved for later, more complex computer algorithm and program development for NEPDIS.

The following classes or types of tasks can be identified by using the commonality procedure to analyze a task inventory:

- omnibus
- embodied
- identical
- unique.

Omnibus tasks contain (embody) all work-behaviors applicable to less complex tasks (tasks of lesser magnitude and scope). Omnibus tasks have greater task complexity levels. Embodied tasks are less complex than omnibus tasks and are subordinate to and components (subsets) of omnibus tasks. Identical tasks have 100 percent common components with other tasks to which they are similar. Unique tasks have no common components with any other tasks. These unique tasks neither embody nor are they embodied in another task.

The next section will will describe the outputs of the NEPDIS FEA.

SECTION IV

NEPDIS FEA OUTPUTS

The task inventory outputs produced by the analysis of the task inventory data base fall into the following three groupings (see figure 2):

- First stage outputs--descriptive and evaluative criteria used to organize and evaluate the task hierarchies
- Second stage outputs--subsets and extrapolations of the JTI for specific purposes
- Final stage output product--a master JTI covering an entire rating.

FIRST STAGE ANALYSIS OUTPUTS. The first stage analysis outputs (or internal analysis outputs) are the following: commonality, complexity, componency, and criticality. Commonality is the index of similarity between tasks. Complexity is an index of the degree and quantity of incorporated subordinate behaviors for each task. Componency indicates the hierarchical relationship of tasks within the JTI (see figure 9).

The computer printout indicating task componency relationships (figure 9) shows the following items: abbreviated task statements, task "signature," complexity measure for each task, task identification number, and type of task in componency terms. The abbreviated task statements are shown as the first line of each block. Listed to the right of each block is the measure of the complexity of each task. The task identification number is listed under the measure of complexity and to the right of the task "signature" block. Examples of omnibus tasks are shown at the top and bottom of the figure. Omnibus tasks usually have greater complexity than embodied tasks. Examples of embodied tasks are shown in the middle of the figure. This printout provides the JTI user with the componency relationships between job tasks. The relative importance of performing a specific task is indicated by criticality. Internal analysis outputs such as componency and criticality can be used to decide the type and amount of relationships (i.e., quantifying these relationships) among tasks in the occupational inventory.

SECOND STAGE ANALYSIS OUTPUTS. The second stage analysis outputs are: JTI subsets (a reduced JTI), "shredded-out" JTI, hierarchical JTIs, sorted JTIs, and skill and knowledge JTIs. The reduced JTI is a JTI with duplicate or common tasks removed from it. The "shredded-out" JTI gives the Navy job tasks for each skill level or pay grade. The obtained relationship of a normally distributed job task complexity among enlisted job task skill levels was made possible by assuming a normal distribution for the distribution of task complexity (see figure 10).

It was considered likely to the NEPDIS developers that the distribution of task complexity within a Navy rating would be symetrically distributed. That is, the most frequently performed tasks would be at medium level of

TYPE OF TASK

```
AE 0022 0002 01 1FTMM ISOLATE FAULT/TROUBLESHOOT AFCS 57560
GENERAL     2131112210000000000000000000   COMPLEXITY = 2.39          OMNIBUS          137
D.S.    1   1331331000000000000000000000   AE 0027 0002 01 1FT M4
SKILL   1   2111300000000000000000000000
SKILL   2   1111000000000000000000000000
SKILL   3   3000000000000000000000000000
SKILL   4   3333333000000000000000000000
SKILL   5   3333332220000000000000000000

AE 0015 0222 01 POC C3 OPERATIONAL CHECK SW RATE GYRO CN 495A/AJR-3  57A4020
GENERAL     2213211221C000000000000000000   COMPLEXITY = 2.38          OMNIBUS          138
D.S.    1   3323332323000000000000000000   AE 0015  0222 01 POC C3
SKILL   1   2221300000000000000000000000
SKILL   2   2322000000000000000000000000
SKILL   5   3233223230000000000000000000

AE 0015 0168 01 POC MM OPERATIONAL CHECK DISPLACEMENT GYRO 57M1
GENERAL     2213211220000000000000000000   COMPLEXITY = 2.36          EMBODIED 111  1  139
D. S.   1   3323332323000000000000000000   AE 0015 0168 01 POC M4
SKILL   1   2221300000000000000000000000
SKILL   2   2322000000000000000000000000
SKILL   5   3233223230000000000000000000

AE 0008 0058 C1 PBC C3 PERFORM BENCH CHECK AUTO PILOT WARNING LIGHTS FLASHER 52118
GENERAL     2113211120000000000000000000   COMPLEXITY = 1.34          EMBODIED 112  2  140
D. S.   1   2323210003000000000000000000   AE 008 0058 01 POC C3
SKILL   1   2111300000000000000000000000
SKILL   5   1213211130000000000000000000

AE 0024 0646 01 1FT C3 ISOLATE FAULT/TROUBLESHOOT MT 3489 57578
GENERAL     2111111210000000000000000000   COMPLEXITY = 1.02          EMBODIED 113  3  141
D.S.    1   3313111002000000000000000000   AE 0024 0646 01 1FT C3
SKILL   2   2311000000000000000000000000
SKILL   5   1223211210000000000000000000

AE 0022 0002 01 1FT MM ISOLATE FAULT/TROUBLESHOOT AFCS 57510
GENERAL     3123100020000000000000000000   COMPLEXITY = 2.37          OMNIBUS          142
D.S.    1   3333333003000000000000000000   AE 0022 0002 01 1FT M4
```

Figure 9. Computer printout (facsimile) indicating task componency relationships.

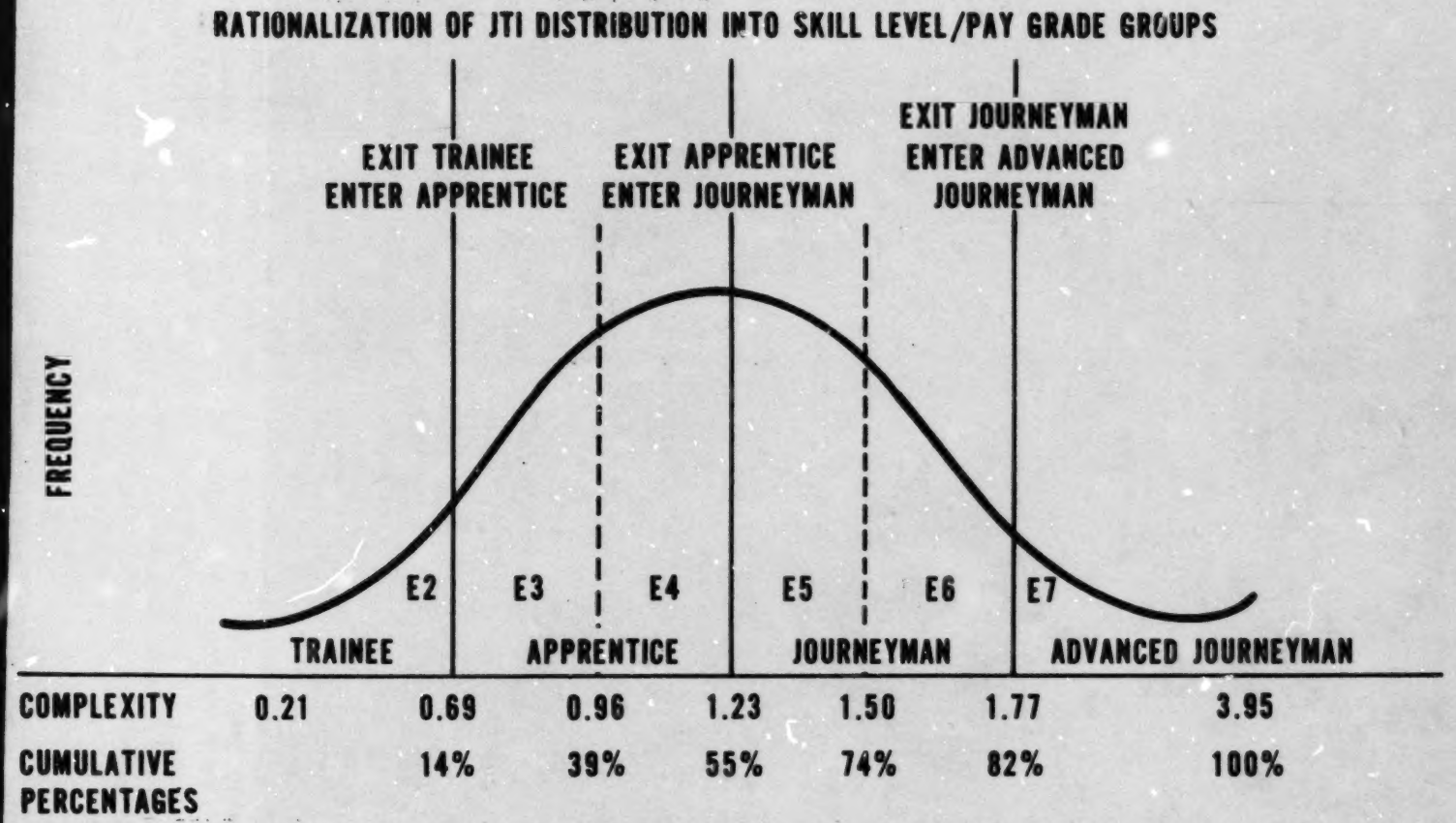

Figure 10. Computer-produced task distribution diagram.
(For illustration, this graphic depiction is more symmetrical than the actual computer printout)

task complexity with the most complex and least complex tasks occurring least frequently. Further, it was expected that this distribution would not only be symmetrical, but it would be distributed as a normal curve. When the analysis programs computed the complexity levels of all representative (noncommon) tasks within a Navy rating, the distribution of frequency of tasks by task complexity level approximated a normal distribution. It was further observed that there was a similarity between the subdivisions of the normal curve (standard deviations) and the subdivisions of a Navy rating (skill levels). It turned out that this correspondence between standard deviations of the normal curve and the divisions between task complexity among skill levels in a rating were very close. So close, in fact, that the NEPDIS developers came to define the division points between skill levels in a task complexity distribution as the standard deviations within the task complexity distribution for each Navy rating. The emerging relationship (shown in figure 10) between the skill levels of tasks and enlisted pay grade levels provided a training guideline for training program designers. Thus, this relationship turns out to be a convenient way to use the job task complexity relationships for training purposes. This correspondence between the subdivisions of Navy rating skill levels (on enlisted pay grades) and standard deviations of a normal curve are illustrated below:

-2SDs = trainee skill level (E2)
-1SD = apprentice skill level (E3 and E4)
+1SD = journeyman skill level (E5 and E6)
+2SDs = advanced journeyman (E7)

Note these divisions in figure 10.

The hierarchical JTI shows job tasks arranged in the inter/intra-task hierarchies and relationships. JTIs may be sorted by equipment, platform, system, NECs, component tasks, etc. Knowledge JTIs show skill and knowledge factors and further show how these factors are included in the tasks listed in the data base.

Further outputs of the JTI are computer JTI reductions by "commonality sweep", computer-produced prioritizing of task and skills for training, and a model of the products derived from a comprehensive job task inventory. The Computer JTI reductions by "commonality sweep" (see figure 11) show the following about job tasks: tasks for four avionics ratings, types of JTIs with varying amounts of commonality removed from them, number of tasks in the JTIs, and number of tasks in each rating. Information about the following are listed in figure 11: the four avionics ratings plus the total of all four ratings, the types of JTIs with varying amounts of commonality removed from them, the number of tasks in the various modified JTIs for each rating, and the corresponding numbers of job tasks for all four ratings. It can be seen from studying the figure that the number of tasks in each rating is less for JTIs with common and embodied tasks removed as compared to the number of tasks in the master JTI listings.

The computer-produced prioritized tasks and skills for training (see figure 12) have the following aspects: billet description, task and skill identifying format, supporting skill statements, training setting as assigned by the computer, training priority, and training setting for tasks and supporting skills. It can be seen that the computer has ordered the

RATING	AX	AT	AE	AQ	ALL RATINGS (AX+AT+AE+AQ)
JTI FOR RATING:					
Duty Subcategory 1	453	725	778	2054	
Duty Subcategory 2	1985	3036	2944	11166	
TOTAL	2438	3761	3722	13220	23141
100% COMMON TASKS REMOVED FROM JTI:					
Duty Subcategory 1	323	528	412	769	
Duty Subcategory 2	464	1039	774	1539	
TOTAL	787	1567	1186	2308	5848
100% COMMON TASKS REMOVED EMBODIED TASKS REMOVED FROM JTI:					
Duty Subcategory 1	101	160	212	180	
Duty Subcategory 2	190	268	257	340	
TOTAL (OMNIBUS TASKS)	291	428	469	520	1708

Figure 11. JTI reductions via "Commonality Sweep" by computer.

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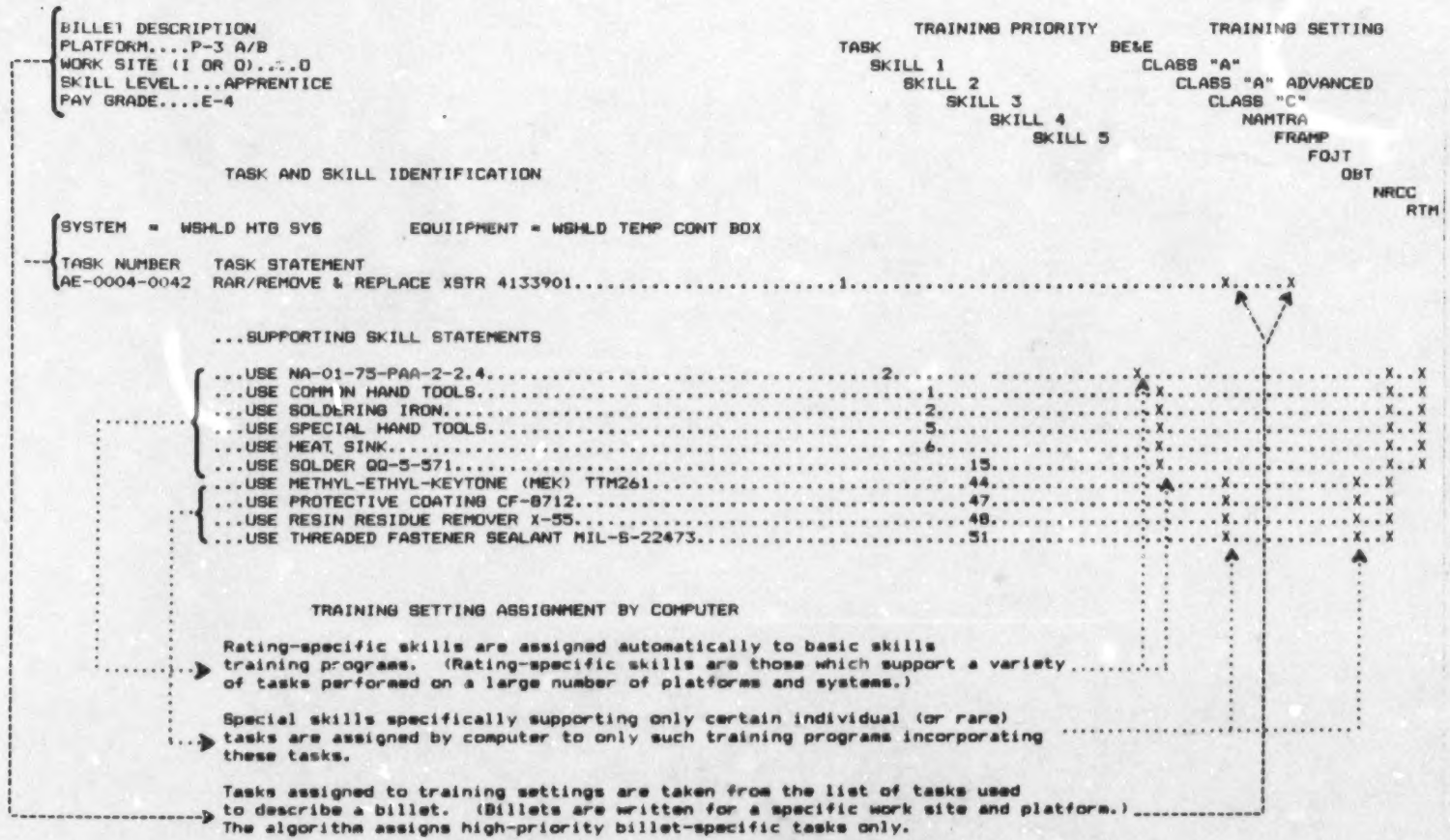
BILLET DESCRIPTION
PLATFORM....P-3 A/B
WORK SITE (I OR O)....O
SKILL LEVEL....APPRENTICE
PAY GRADE....E-4
TRAINING PRIORITY
TASK
SKILL 1
SKILL 2
SKILL 3
SKILL 4
SKILL 5
TRAINING SETTING
BE&E
CLASS "A"
CLASS "A" ADVANCED
CLASS "C"
NAMTRA
FRAMP
FOJT
OBT
NRCC
RTM
TASK AND SKILL IDENTIFICATION
SYSTEM = WSHLD HTG SYS
EQUIPMENT = WSHLD TEMP CONT BOX
TASK NUMBER
TASK STATEMENT
AE-0004-0042
RAR/REMOVE & REPLACE XSTR 4133901
...SUPPORTING SKILL STATEMENTS
...USE NA-01-75-PAA-2-2.4
...USE COMM'N HAND TOOLS
...USE SOLDERING IRON
...USE SPECIAL HAND TOOLS
...USE HEAT SINK
...USE SOLDER QQ-S-571
...USE METHYL-ETHYL-KEYTONE (MEK) TTM261
...USE PROTECTIVE COATING CF-8712
...USE RESIN RESIDUE REMOVER X-55
...USE THREADED FASTENER SEALANT MIL-S-22473
TRAINING SETTING ASSIGNMENT BY COMPUTER
Rating-specific skills are assigned automatically to basic skills training programs. (Rating-specific skills are those which support a variety of tasks performed on a large number of platforms and systems.)
Special skills specifically supporting only certain individual (or rare) tasks are assigned by computer to only such training programs incorporating these tasks.
Tasks assigned to training settings are taken from the list of tasks used to describe a billet. (Billets are written for a specific work site and platform.) The algorithm assigns high-priority billet-specific tasks only.

Figure 12. Computer-produced task and skill prioritization for training, selection of training settings, and rationale.

training priority in the order of the task and skill statement listings. The skills with higher training priorities are recommended for training in BE&E, class "A", NRCC, and RTC settings. Skills with lower training priorities are recommended for training at class "C" and OBT settings. This printout can be used by the training developer to identify the priority skills and training settings for each occupational task.

A model (see figure 13) was developed to show how the products derived from a comprehensive job task inventory could be used to support the needs of manpower, training, and personnel managers. More specifically, this model showed how to produce task-specific billet descriptions, rating specific skills, and rating-specific knowledges. Task-specific billet descriptions were derived from the total task inventory by identifying those tasks assigned to a single pay grade for a specific platform at a specific worksite. Rating specific skills were identified as those skills which the worker in a given rating needed to competently perform job tasks at a particular pay grade level. Although the specfic details of deriving rating specific knowledges have not yet been established, these details will almost certainly include information taken from the task descriptive characteristics. The following listing shows the three areas of products derived from the NEPDIS job task inventory and the detailed steps involved in deriving each of these products (compare with figure 13).

Deriving task-specific billet descriptions:

- prioritizing training tasks
- assigning tasks to training settings
- establishing rating advancement requirements for specific tasks
- certifying rating incumbents for a specific billet
- determining billet manpower requirements.

Deriving rating-specific skills:

- prioritizing skills for training
- assigning skills to the training setting
- establishing skill advancement requirements
- certifying incumbents for a pay grade
- identifying the knowledge needed for specific ratings. The steps involved in deriving this rating-specific knowledge are:
  - .. assigning rating-specific knowledge to a specific training setting

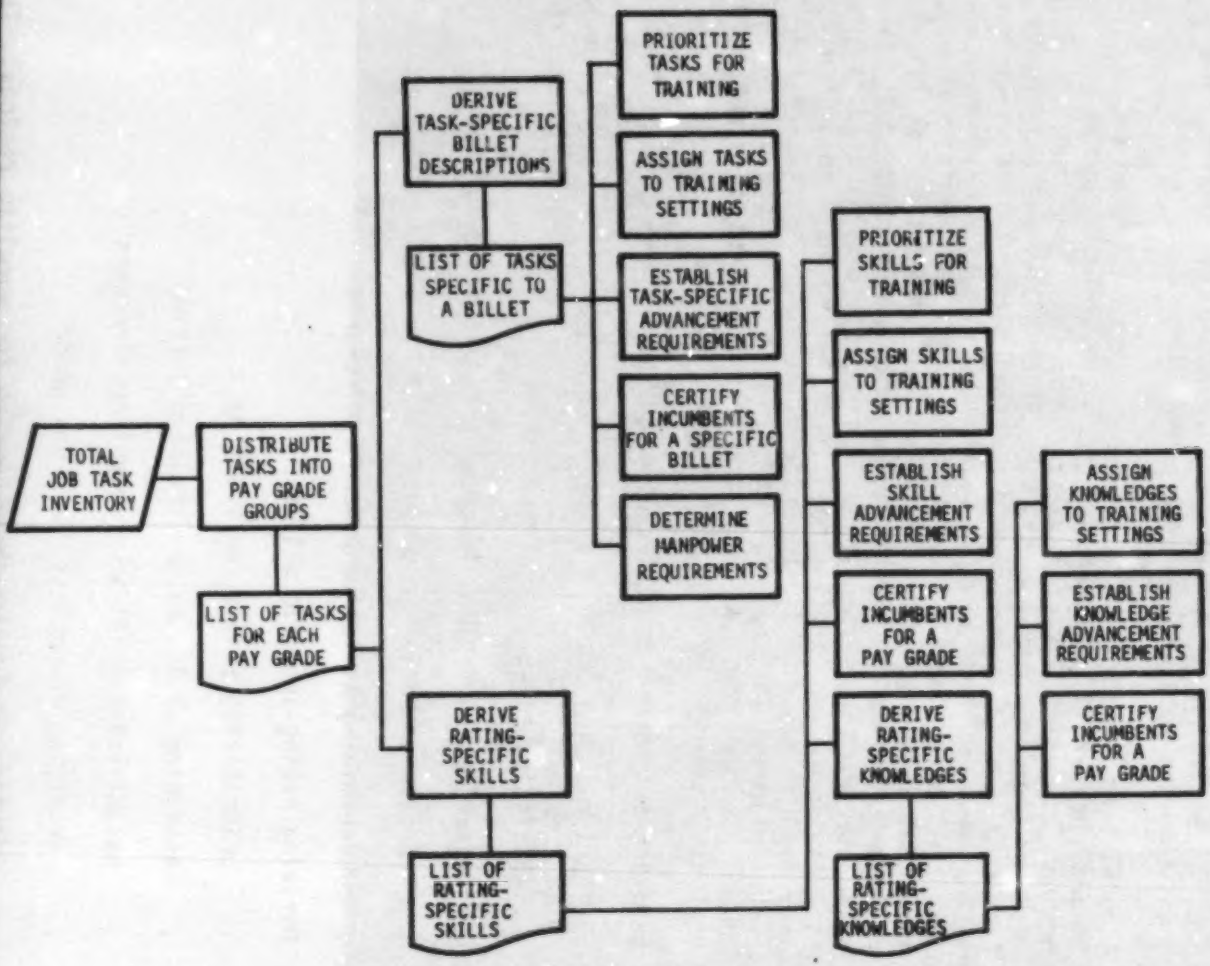
TOTAL JOB TASK INVENTORY
DISTRIBUTE TASKS INTO PAY GRADE GROUPS
LIST OF TASKS FOR EACH PAY GRADE
DERIVE TASK-SPECIFIC BILLET DESCRIPTIONS
LIST OF TASKS SPECIFIC TO A BILLET
PRIORITIZE TASKS FOR TRAINING
ASSIGN TASKS TO TRAINING SETTINGS
ESTABLISH TASK-SPECIFIC ADVANCEMENT REQUIREMENTS
CERTIFY INCUMBENTS FOR A SPECIFIC BILLET
DETERMINE MANPOWER REQUIREMENTS
DERIVE RATING-SPECIFIC SKILLS
LIST OF RATING-SPECIFIC SKILLS
PRIORITIZE SKILLS FOR TRAINING
ASSIGN SKILLS TO TRAINING SETTINGS
ESTABLISH SKILL ADVANCEMENT REQUIREMENTS
CERTIFY INCUMBENTS FOR A PAY GRADE
DERIVE RATING-SPECIFIC KNOWLEDGES
LIST OF RATING-SPECIFIC KNOWLEDGES
ASSIGN KNOWLEDGES TO TRAINING SETTINGS
ESTABLISH KNOWLEDGE ADVANCEMENT REQUIREMENTS
CERTIFY INCUMBENTS FOR A PAY GRADE

Figure 13. Products derived from a comprehensive job task inventory.

.. establishing the knowledge needed for specific advancement requirements

.. certifying ratings incumbents to a specific pay grade.

The JTI results in useful training products or training-oriented decision-making information. The NEPDIS FEA computer analysis programs can be used to produce the following JTI outputs: learning objectives for training course curricula (see figure 14), enabling objectives for training courses, alternate training objectives, and as a means of sorting objectives by rate and pay grade.

The NEPDIS FEA Computer Printout of a Learning Objective (figure 14) is basically comprised of two parts. The conditions and standards for translating job task conditions into supporting skills for the task are shown in figure 14. The results of the computer translation of task conditions into supporting skills for each task are also shown in figure 14. Information about the support material and test equipment needed for the task are listed in the figure. The terminal learning objective (TLO) based upon the generic task statement and supporting skills for the trainee are provided for the curriculum developers. Also, the skill area and the skill levels and criticality for the job task are shown for each of the supporting skills in the figure. The NEPDIS FEA computer program translates the job tasks into TLOs which the curriculum writer then can use to build a training curriculum to teach these job tasks to enlisted personnel. The JTI also provides a means of examining the embodied tasks within a skill. Thus, the JTI supplies the detailed information needed for developing more accurate and efficient Navy training courses.

FINAL STAGE OUTPUT PRODUCT. The primary output is a master JTI covering an entire rating. This JTI specifies the job tasks and skills Navy enlisted personnel need to acquire to perform their assigned tasks at each pay level. The JTIs are separate and different for each rating. Emphasis of these JTIs are on operator/technical tasks. The JTI resulting from the NEPDIS FEA analysis is the desired JTI for each Navy rating.

SAMPLE TERMINAL OBJECTIVE FOR TASK #AE-0001-0020

GIVEN:

CUE.....REPAIR COMPLETE

REFERENCE.....NA-01-75PAA-2-12

TOOL.....COMMON HAND TOOLS (ELEC/ELECTRO)

TOOL.....SPECIAL HAND TOOLS (ELEC/ELECTRO)

SUPPORT MATERIAL.....FUSE

SUPPORT MATERIAL.....SWITCH

SUPPORT EQUIPMENT.....POWER UNIT 28V 400HZ (APU-10)

TEST EQUIPMENT.....RPM GAUGE

TEST EQUIPMENT.....AMMETER

TEST EQUIPMENT.....MULTIMETER

THE TRAINEE WILL BE ABLE TO PERFORM MAINTENANCE CHECK ON ROTATING

BEACON ASSEMBLY 44126

OF EQUIPMENT.....EXTERIOR LIGHTING (44100)

OF SYSTEM.....LIGHTING SYSTEM (44000)

OF PLATFORM.....P-3 A/B (APBC)

TO STANDARD.....IAW REFERENCE PUBLICATION

SUPPORTING SKILLS (TASK SIGNATURE)

SKILL AREA	SKILL (BEHAVIOR)	SKILL LEVEL/CRITICALITY
GENERAL	FOLLOW SAFETY PRECAUTIONS (CONSEQUENCES)	VIOLATION MAY CAUSE MINOR DAMAGE TO EQUIPMENT AND/OR MINOR INJURY TO PERSONNEL
GENERAL	RESPOND TO CUES (SPEED)	IMMEDIATE RESPONSE NOT REQUIRED--ALLOWS AMPLE TIME FOR RESEARCH IF NECESSARY
GENERAL	GAIN ACCESS (ACCESSIBILITY)	EASILY ACCESSIBLE: LITTLE CONSEQUENCE IN COMPLEXITY OF TASK
GENERAL	MAKE ADJUSTMENT/TAKE MEASUREMENTS	PRECISE--WITHIN ALLOWABLE ERROR (PUBLISHED TOLERANCES)
GENERAL	CONTINUE UNTIL COMPLETION	ACTION MAY START AND STOP WITHOUT AFFECTING OVERALL PERFORMANCE
GENERAL	VIEW/MANIPULATE (MINIATURIZATION)	SIZE IS OF LITTLE CONSEQUENCE ITEM CAN BE VIEWED WITH NORMAL VISION AND MANIPULATED WITHOUT SPECIAL TOOLS
GENERAL	HANDLE/REPOSITION OBJECTS (SIZE/SHAPE)	SIZE/SHAPE IS OF LITTLE CONSEQUENCE IN POSITIONING
GENERAL	HANDLE/REPOSITION OBJECTS (WEIGHT)	LIGHT WEIGHT--EASILY POSITIONED WITH ONE HAND
CHECK/TEST/ INSPECT	OBSERVE/ANALYZE INDICATING (DYNAMICS)	ANALYZE DYNAMIC INDICATIONS ONLY
CHECK/TEST/ INSPECT	OBSERVE/ANALYZE INDICATIONS (SENSORS)	ANALYZE BOTH TEST EQUIPMENT AND SENSORY INDICATIONS

Figure 14. Computer printout (facsimile) of terminal learning objective (TLO).

SECTION V

SUMMARY

The NEPDIS was designed to be a fully computerized system supporting manpower, personnel, and training management. At present the system has the capability to establish an occupational data base and a computer-assisted methodology to perform job/task/skill and training analyses. The NEPDIS is made up of five major subsystems and seven files. The only developed subsystem is the training development subsystem which includes methodologies for acquiring and analyzing task and skill data and maintaining training program development records. Only the task inventory file, a product of the NEPDIS front end analysis (FEA) process, is operational.

Input for the NEPDIS front end analysis process comes from documented occupational data sources which are put in the computer by Navy subject matter experts. Computer programs analyze the job task data and produce various outputs. The primary front end analysis output is a job task inventory listing all job tasks for a given Navy rating and pay grade. Other outputs of this data base analysis are various internal criteria (measures) of the task data (criticality, commonality, componency, and complexity) and various modifications and sortings of the JTI, such as terminal learning objectives, task-specific billet descriptions, rating-specific skills, and rating-specific knowledges.

The NEPDIS front end analysis process has had a trial application with four avionics ratings. This application will be the subject of the third report in this series.

REFERENCES

Ansbro, T. M. An overview of the naval enlisted professional development information system (NEPDIS). Technical Report No. 122. Training Analysis and Evaluation Group (Code 1), Naval Training Equipment Center, Orlando, FL 32813. May 1982.

Cagle, M. W. Dimensions. TraNavy: Magazine of Naval Training, 1973, p.1. NEPDIS automated data systems implementation plan. Pensacola, FL: Chief of Naval Education and Training (CNET), 1977.

Procedures for instructional systems development (NAVEDTRA 110). Pensacola, FL: Chief of Naval Education and Training (CNET), 12 July 1978.

Manpower, training and personnel plan (OPNAVINST 5310.13). Washington, DC. Chief of Naval Operations (OP-01D). 28 January 1978.

Davis, D. D. Diaglogue. CAMPUS: The Navy Education and Training Monthly, January 1976, pp. 24-27.

Davis, D. D. Diaglogue. CAMPUS: The Navy Education and Training Monthly, April 1977, pp. 22-27.

Davis, D. D. Naval enlisted professional development information support system. Proceedings of the National Security Industrial Association of the State-the-Art Application of Advanced Training Technology, April 1977a.

Davis, D. D. Naval enlisted professional development information support system. Journal of Educational Technology Systems, 1977b, 6(2), 133-141.

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